



Forest Insect & Disease Management

NA-TP-2

EVALUATION OF 3-0 AND 4-0 RED PINE

IN EVELETH NURSERY,

MINNESOTA, 1979

by

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INTRODUCTION

Survival of outplanted red pine on the Superior National Forest in Minnesota has been poor since 1967.^{1/} This reduced survival has been partly attributed to improper planting practices (Cooley 1974), root rot and a lack of mycorrhizae. A survey of red pine at Eveleth Nursery by State and Private Forestry in 1977 revealed that root rot, caused by Fusarium oxysporum (Schl.) em. Snyder & Hans., was present in 20 to 60 percent of the seedlings examined. Between 12 and 40 percent of the rootlets were symptomatic.

A subsequent survey of plantations on the LaCroix, Virginia, and Tofte Ranger Districts of the Superior National Forest in September 1978 showed Fusarium oxysporum to be the primary cause of seedling death in 4 of the 11 plantations examined (LaMadeleine 1979).

The timber-management staff of the Superior National Forest requested an evaluation of the red pine at Eveleth Nursery so they could estimate possible losses in 1979 and thus determine if they should consider an alternate source of stock.

OBJECTIVES

Objectives of the study were to determine the extent of root rot in Eveleth Nursery stock prior to lifting in 1979 and to identify stock with the best survival potential.

- 1/ Skilling, Darroll, D. 1969. Personal conversation.
USDA For. Serv., North Cent. For. Exp. Stn., St. Paul, Minn.

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BROOMALL, PENNSYLVANIA 19008

METHODS

Seventeen nursery beds were systematically sampled to represent the 3-0 and 4-0 red pine to be lifted in 1979. Fifteen seedlings (three groups of five seedlings) were lifted from each bed, placed in an ice chest, and brought to the laboratory for determination of shoot-to-root ratios, verification of the presence of possible pathogens, and determination of the percentage of mycorrhizal rootlets.

The shoot-to-root ratios were based on fresh weight. The seedlings were immersed in water before examination and were then blotted dry and weighed. Next, the portion of the root system with visible symptoms of root rot was removed and weighed. The percentage of the root system affected by root rot was determined from these data. Seedlings representative of each bed were selected for determination of the percentage of mycorrhizal rootlets.

RESULTS AND DISCUSSION

The red pine planting stock for 1979 (Table 1) was in much better condition than the stock examined in 1977 and 1978. The shoot-to-root ratio was good for seedlings in most of the beds examined, the percentage of mycorrhizal rootlets was greater, and the percentage of rootlets with root rot was smaller. A shoot-to-root ratio of less than 4:1 is recommended for the Lakes States, and a ratio less than 3:1 is considered better (Stoeckeler and Jones 1957). Few data exist on the amount of root rot necessary to reduce survival or the percentage of mycorrhizal rootlets necessary to increase survival in the northeast. In the southeast, if more than 10 percent of a seedling lot has 25 percent of the root system affected by root rot, the seedlings are not outplanted. Relative to mycorrhizae, at least 50 percent of the rootlets should be mycorrhizal for enhancement of seedling survival.

The 4-0 red pine in blocks 19 and 4 probably had the best survival potential of any stock examined. Some root rot was present, but the seedlings had a good shoot-to-root ratio and the percentage of mycorrhizal rootlets approached recommended levels.

The 3-0 red pine differed little from bed to bed. In block 11, units 4 and 9, the seedlings had slightly higher levels of root rot (in some seedlings 7 to 9 percent of the rootlets were affected), and in block 10, units 5, 6, and 8, the percentage of mycorrhizal rootlets was low. The seedlings looked satisfactory, however.

Table 1.--Incidence of root rot and mycorrhizae in
planting stock for 1979 - Eveleth Nursery

Block-Unit	Seedling Age	Shoot-to-root ratio (mean)	Root rot ^{a/}	Mycorrhizae ^{b/}
4-9	4-0	3:1	low	moderate
19-2	4-0	2:1	low	moderate
19-3	4-0	2:1	low	moderate
11-4	3-0	3:1	moderate	low
11-6	3-0	2:1	low	low
11-7	3-0	2:1	low	moderate
11-9	3-0	2:1	moderate	moderate
10-4	3-0	2:1	low	moderate
10-5	3-0	2:1	moderate	low
10-6	3-0	2:1	low	low
10-8	3-0	3:1	low	low

a/ Incidence of root rot: Low - less than 2 percent;
moderate - 2-10 percent.

b/ Incidence of mycorrhizae: Low - less than 31 percent;
moderate - 31-50 percent. Note: Levels over 50% are
considered necessary to increase seedling survival.

Fusarium oxysporum was isolated from the seedlings examined and was identified as the cause of the root rot. The estimate of root rot was conservative, since it was based only on symptom expression. Other portions of the root system undoubtedly were infected, but symptoms were not yet apparent. It is therefore reasonable to assume that some deaths will occur when this stock is outplanted. However, mortality is not expected to be high enough to affect management objectives.

RECOMMENDATIONS

The following procedures will help reduce losses of outplanted red pine seedlings in the future:

1. Use proper fumigation techniques in the nurseries. Such treatment will effectively reduce or eliminate the root rot pathogens in the soil.
2. Follow recommended fertilization guidelines. Excessive levels of phosphorus (greater than 150 lb P_2O_5 /acre) reduced the effectiveness of mycorrhizal fungi, and excessive levels of nitrogen (definitive levels are being determined) enhance the activity of some root rot pathogens. In addition, excessive fertilization may produce an unacceptable shoot-to-root ratio.
3. Do not overprune roots.
4. Follow good planting practices.

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